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ABSTRACT

A review of literature suggests that motor competence in the areas of perceptual-motor integration, coordination, and balance affects the academic achievement of young children. Organized physical instruction seems to be beneficial to elementary school children, and the earlier the instruction is begun, the greater the gains. What is uncertain is exactly what should be taught. Programs that focus on only one element, such as strict visual perceptual training, or the Delacato emphasis on creeping, appear to have more critics than do more generalized movement programs. It can be surmised that this is due to the fact that it has not been established that movement in itself affects the central nervous system. Therefore, practitioners are on shaky ground if they prescribe one specific movement to remediate cognitive difficulties. A generalized movement program could incorporate creeping within a context of numerous motor skills, as well as academic and social skills. The potential for helping students would be much greater with such a program. (RH)

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The Relationship Between Formal Movement Education in the Elementary School and Increased School Competency

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Introduction

In efforts to be cost efficient, physical education on the elementary level has been virtually eliminated. According to the California Education Code, 200 minutes of physical education are required for each ten days of school (section 51210). From observation, this requirement is normally fulfilled with a twenty minute recess or with a game of Dodge Ball. There is not enough money for specialists, there is little or no appropriate space, and there is no time within the curriculum demands. Formal movement education is considered nice, but unnecessary.

Is physical education a frill or is it an integral part of the elementary curriculum? This question encompasses a myriad of underlying concerns: Does physical education actually promote physical fitness? Is there a relationship between fitness and maturation, school competency, or self esteem? Is there a relationship between fitness, psychomotor skills, and perceptual skills? How much activity is optimum? What type of activities are best suited for the desired results? What are our desired results?

Statement of the Problem

The purpose of this review is to research one area within this overall question: Is there a relationship between formal movement education in the elementary school and increased school competency, most especially reading and self-esteem?

In this research, formal training is used to mean separate instruction, comprising approximately three hours a week or more and conducted by a specialist in the field. Movement education is a generic term used to describe various programs such as aerobics, sports, gymnastics, swimming, fitness training, pyschomotor, and perceptual motor coordination. To make matters even more unstable one method of teaching, even a specific class like gymnastics, varies greatly from another method. Further, most research on physical education studies do not define their use of the term. Therefore movement education is broadly defined as any program that focuses on physical activity. School competency is defined as success in school. In reading, student success can be measured by comparing scores on standardized reading tests. Increased self-esteem can be measured by self-assessment and by parent and teacher observation.

Rationale

Historically there has been much interest in the relationship between physical, mental, and emotional development. The development of the physique was held in high esteem during the Greek and Roman civilizations. During the Middle Ages mind and body were seen as opposites; the body was considered an evil force to be combated by spiritual and intellectual forces. The Renaissance began a reuniting of physical and mental elements. In the 1700 and 1800's Rousseau and others believed that the physical needs of children should be expressed. In the United

States, the Puritan ethic again branded all physical recreation as evil but this position slowly changed. After World War II, scholars began to focus on the interaction between the child's physical and mental abilities. Various theories began to flourish: visual-perceptual, neurological repatterning, sensory integration, and learning games theories. (Cratty, 1972) Current research on the relationship between movement and mental abilities has also taken numerous approaches.

Background and Need

Two lines of reasoning lead to the present examination of the relationship of movement education to academic success: the relationship of movement to neurological organization and the relationship of movement to developmental maturity.

Ayres (1979) describes the central nervous system as an information gathering system. At every moment information is being transmitted from all parts of the body. Every sensation, from the basic five senses and from the proprioceptive and vestibular systems, is used to process and clarify information coming into the brain. For example, we look at an object like a tree; our sense of sight processes this information and sends it to the brain. This is not useful information without accompaning sensations: the proprioceptive system tells us what position we are in and where we are. The vestibular system tells us our relation to the tree, whether it is upright, whether we are upright, and how the tree fits into the environment as a whole. Disabilities within the cognitive sphere can be

remediated or at least helped by sensory stimulation and integration.

Closely alined with Ayres theories are the perceptual-motor theorists: Getman (1952), Kephart (1960), Barsch (1968), and others. Although they differ in many specifics, these theorists believed that enhancing motor skills promoted perceptual abilities and, in turn, heightened perceptual skills increased cognitive abilities.

The developmental patterning theories of Doman (1974), Delacato (1964), and Cohen and Mills (1979) rested on the belief that the human organism develops through specified movement patterns. If there is a break down in this movement development, there will be a resulting difficulty in cognitive functions. Conversely, learning disabilities can be remediated or helped by retracing the developmental movement patterns and strengthening any weak spots.

All these theories, the sensory motor, perceptual-motor, and developmental patterning, are in agreement that movement, in and of itself, will alter functions in the central nervous system. Further, they hold that these changes in the central nervous system will promote increased cognitive functions. Although this work was primarily oriented to children with learning difficulties, it is only a small step to conclude that if movement can help learning disabled children, then it should promote increased capacities in normally achieving children.

The second train of theories leading us to the present interest in the relationship between movement and academics originated from educational psychologists. Developmental psychologists like Piaget (1965) believed children learn through movement. Children go through a sensory motor phase where physical movement and manipulation of the environment serves as a foundation for developing mental concepts. Cratty (1979) stated that children mature along four family lines: cognitive, verbal, motor, and perceptual. As the child develops, these families grow in complexity and diffuse while at the same time many skills interconnect in a process called bonding. For example, in a complex task like reading, a child must bond many and varied abilities such a motor skills, visual-perceptual skills, cognitive skills and so on. It holds, therefore, that if a child's movement and perceptual skills were enhanced, that this increase in skills would foster the development of cognitive and verbal skills.

Barsch (1968) in his theory of "Movegenics" states that "the fundamental principle underlying the design of the human organism is movement efficiency" (p.36). He concludes very eloquently on the role of movement in life:

> Without movement atrophy occurs. Without movement stagnation sets in. Without movement no change takes place. Man moves to change something. As a dynamic being man is constantly on the move to change. His

> nature demands it and his design defines it. Life is movement. Without movement there is death. To understand himself man must come to an understanding of movement. (p.11)

Whether it is through a change of the central nervous system or through the learning process itself, these two lines of theorists saw an intimate relation between movement and learning.

Review of the Literature

Increased Time or Increased Instruction

A classic longitudinal study was carried out in Vanves, France, from 1951 to 1960. This study examined the relationship between time spent on physical activity and academic achievement. Academic instruction was reduced from 23 1/2 to 15 hours a week and physical education was increased from 2 to 8 hours a week. According to Keller (1982) the experimental group surpassed the control group academically and overall in health, stamina, and attitude. In addition the experimental group appeared more mature and more independent.

Shephard, Roy, LaBarre, Volle, Jéquier, Lavallée, Rajic (1982) warn that the Vanves study was not designed as a rigorous controlled experiment. The results were possibly contaminated by a "halo" effect where the experimental group felt that they were special and therefore the improvement did not result solely from the change in curriculum.

The Trois Riviere, Canada, experiment (Shephard et al., 1982) attempted to duplicate the Vanves study under more controlled

conditions. The study sampled 546 students throughout six years of elementary school. Entire classes from one urban and one rural school were assigned to the experimental program. They were given one hour of physical education a day with a trained specialist. The control classes were taken from the same two schools so as to receive academic instruction from the same group of teachers. The control group received the standard 40 minutes of physical activity a week under the supervision of a nonspecialist teacher.

The influence of the experimental physical program on academic achievement was measured by teacher grading and by performance on the Province-wide examinations held in the 6th grade. Except for grade one, where the control group had higher scores, all the grades improved for the experimental groups. On the 6th grade test, the results were inconclusive. The experimental group did better in mathematics; there was no difference between the two groups in French; and the experimental group did slightly worse than the control in English and analytical reasoning.

Shepard et al. (1982) comments: "It seems fair to conclude from the Trois Riviere study that a substantial segment of primary school curricular sime can be reallocated to physical education without jeopardizing academic learning" (p. 20).

Two aspects of the Trois Rivieres study warrant further discussion. Shepard et al. objected to several earlier studies of increased physical education time because physical

performance was not measured or did not change. He states that the "prime justification of an activity program must be its influence upon the physical development of the child" (Shepard et al., 1982, p. 20). If academic skills are enhanced that is a welcome but secondary effect. This is an unnecessary limitation. It would be possible to devise a physical education program with the primary goal of enhancing academic skills; any physical gains would be welcomed secondary results. The emphasis would be on using movement as a different vehicle or mode of learning to approach the fundamental academic concepts.

The second notable aspect of this study was that the teachers of the experimental group thought the children improved in behavior although this improvement was not consistently borne out in their citizenship scores. Eighty percent of the teachers were in favor of increased physical education time, none were opposed, and twenty percent were neutral. An impressive aspect of the Vanves results was the increased health and the improved attitude of the experimental group. It appears that there might have been a similar effect here but it was not clearly indicated. Perhaps a qualitative, in depth study of the growth patterns would be in order.

An excellent and rigorous investigation of the effect of an organized physical education program on intellectual performance was undertaken by Ismail and Gruber in 1964.

This study was conducted in Fayetteville, Arkansas. The sample, 142 fifth and sixth grade children, was divided into two matched groups according to intellectual performance. Each of the experimental and control groups consisted of 71 children, 33 boys and 38 girls; and within each group 18 were labeled high achievers, 44 medium achievers, and 9 low achievers. Achievement was assessed by IQ scores on the Otis IQ test and on Stanford Academic Achievement Test. The test characterestics for this IQ and achievement test were not included.

A formal physical education program was developed by a team of experts. The number of physical education classes varied from class to class in order to fit school schedules and facilities. The control group continued with their existing schedule of physical education which consisted of recess periods of free play. Each child in the control group spent time in free play periods equal to that time spent by a matched member in the experimental physical education program.

In analyzing the results, it was found that the organized physical education program had no effect on mean IQ scores. There was, however, a favorable effect on academic achievement. In looking at the high, medium, and low achievers it appears that the high and medium achievers made the most gains while the low achievers made slight gains. Ismail and Gruber (1967) felt that if the experiment had been conducted for a longer

period of time, that the results would have been even more dramatic.

The importance of this study is that the authors took every precaution to keep this study within rigid controls. Their study differs from the Trois Rivieres and Vanves experiment in that the focus here is not on increased time spent on physical education, but rather on increased instruction.

These three studies, conducted in Vanves, Trois Rivieres, and Fayetteville, all focused on increased physical education time or instruction. Closely tied with these investigations are those studies that examined the relationship between motor performance and academic achievement.

Motor Performance

In a 1924 study by Gates (cited in Ismail and Gruber, 1967) the interrelationship of physical, mental, and emotional maturity in elementary children was investigated. According to this study, "Physical superiority, particularly vigor and stamina, influences achievement. Physical fitness appears to exert a greater specific influence upon achievement than does either social or emotional maturity or both combined" (p. 19).

Harris and Jones (1982) conducted a large scale study in Georgia on the relationship between reading, math, and motor performance. The sample included 1767 second, fourth, and sixth grade children. Eight motor performance tests were given and these were correlated with achievement on the Georgia Criterion Referenced Test. No test characteristics were included for this test; however the test was cited so that further information is available.

One or more motor performance variables were found to be significantly related to reading and math scores. "Shape-o-ball" and "sit-and-reach" performance were most frequently related to achievement scores. "Shape-o-ball" is a perceptual motor test and this measure was seen to be most consistently related to reading and math abilities especially in the lower grades. The results of this experiment indicate a low but significant relationship between motor performance and academic achievement.

Ismail and Gruber (1967) conducted a study on the relationship between balance, coordination, and kinesthesis with IQ and academic achievement. The sample involved 211 children, 122 boys and 89 girls, with ages ranging from ten to thirteen years. These children were divided into high, medium, and low achievers. IQ was evaluated by the Otis IQ test and academic achievement was evaluated by the Standford Academic Achievement Test. No test characteristics were included for these two tests. However, all test results were corroberated by teacher evaluation before they were included in the study.

Speed, accuracy, power, and strength did not correlate significantly with IQ. Significant coefficients were found between coordination and IQ. The highest coefficient was found between hop 2 right and one left and IQ (r=.57). Some balance measures also related significantly with IQ. Coordination factors were also found to be the most related to achievement scores and balance had a lower correlation.

Both this study and the one conducted by Harris and Jones (1982) found significant correlations between motor performance and academic achievement. However, the authors differ on what motor skills were significant. Harris and Jones found perceptual-motor skills and Ismail and Gruber found coordination and balance skills as significant indicators of academic achievement.

Personal Development

In Germany, a longitudinal study was conducted from November 1975 to June 1977 (Diem, 1982) to investigate several different questions: Does early motor stimulation create increased personal development in children? Is there a difference in impact between swimming and gymnastics as the motor stimulation? Does the age at which motor stimulation is begun alter the results of the training?

A sample of 165 two to four year old children was selected. These were divided into two groups of twins, that is, children matched in sex, birth order, age, size of household, and financial situation. Motor programs were applied in one hour weekly training sessions. Observations and measures of childrens' growth were conducted every six months. Personal development was evaluated by researchers' observations, by parental observations and inquires, and by videotaped interactions which were evaluated by independent judges. Information describing how the judges were selected was not discussed.

Various forms of motor training were administered:

Partial sample 1: children who had swimming from the third month of life.

Partial sample 2: early swimmers who received an additional motor learning program from 3.6 years.

Partial sample 3: children who began swimming at 2.4 years.

Partial sample 4: this sample was the same as sample 2 and was not used.

Partial sample 5: children who had gymnastic lessons from age 3.6 years.

Partial sample 6: children who received no motor stimulation.

Diem (1982) found that the psychophysical development of the motor stimulated children was accelerated in comparison to the nonstimulated children. The motor stimulated group also appeared more independent, more outgoing, and less easily frustrated. Further, the motor stimulated group showed increased ability in motor skills. The early swimmers showed higher intelligence scores than the other groups.

It appears that motor training does positively affect the personal development of children. From the results, the children who had infant swimming did slightly better than the rest but there was no sample that had infant gymnastics. It is also not clear if there were any major differences within the different motor training groups.

It must be noted that the motor stimulation training occured with the assistance of a parent and that some of the

results may be due to the increased interaction between parents and children.

This study is especially interesting in its complexity and magnitude. It is disappointing that so little information was given on the differences between the groups of motor stimulated children. Either the researchers found few differences or they did not find them noteworthy. In either case this would be valuable information.

Cognition

Rarick (1980) presented a meticulous overview of the relationship between cognitive and motor skills. The human organism is a totality but within the interrelation of parts the evolutionary process has localized specific functions in the central nervous system. The question then becomes how much interplay and adaption is involved between the different mechanisms of the organism.

Evolutionary emergence of abstract intelligence is linked to the growing functional adaptation of the hand. As the hand evolved, it abandoned its locomotive function to one of exploration and creative activities. The hand became a a problem solver and "the basic instrument of intelligence" (Rarick, 1980, p. 176). The developing infant parallels our evolutionary development. The hands, along with the eyes, become the infant's primary method of exploring the environment and this exploration in turn becomes the medium for the development of the infant's intellect. This sensorimotor phase becomes the

base for the concrete experiences necessary for future abstract and symbolic thought. Thus during the sensorimotor phase cognitive and motor functions are inextricably bound. When the child begins to abstract ideas the domains begin to separate.

Intelligence at the infant stage is assessed by motor tests. As the child gets older, the definition of intelligence as well as the testing produres become more symbolic. Rarick feels that the literature shows significant but low correlations between motor and cognitive abilities for young children, but that past third grade, there is no significant relationship. This pattern applies to perceptual-motor activities as well as standard strengh, balance, and endurance skills. He admited that some studies do show significant correlations between coordination and balance and intellectual achievement, but he felt that the preponderance of evidence does not support this conclusion.

Rarick did bring up a very ineresting point. He stated that the process of learning a motor skill employs cognitive functions similar to those needed in purely intellectual pursuits. The acquisition of a new motor skill requires concentrated mental effort and problem solving techniques. The learner must organize subskills in an effective sequence and then transfer control so that the skill becomes automatic. These subskills can be recalled if a new, slightly different motor experience is presented. This theory is clearly seen

in learning to drive a car. A great number of subskills, gas pedal pressure, shifting, turning, braking, and so on, are consciously organized and sequenced. Gradually the skills become automatic, but when one is confronted with a different car, one can recall the skills with conscious effort.

Rarick pointed out that this ability to organize and sequence subskills is what is needed for verbal as well as motor skills. He cautiously stated that a movement program that offers "variable practice" (Rarick, 1980, p. 190), that is, practice on similar but unfamiliar tasks, would benefit cognitive organization. However he cautioned that this theory is not clearly supported by physiological research.

Two educators who have worked with the relationship between movement education and academic skills are Marianne Frostig (1980) and Bryant Cratty (1972). Interestingly, Cratty wrote the forward for Frostig's book, Movement Education: Theory and Practice. In this book Frostig defined the central goals of movement education: "The promotion of good health and a sense of well-being and the development of sensory-motor skills and of self-awareness" (Frostig, 1970, p. 17). This definition presents somewhat circular logic; since well-being, sensory-motor skills and self-awareness are inherent in her definition, any physical education program that does not produce these results would not be considered movement education.

Frostig stated that academic learning can benefit from movement education directly and indirectly. Whole body

movements are helpful in teaching many academic skills directly. Indirectly, movement education promotes the child's ability to learn by increasing memory, concentration, orientation, perceptual skills, associative processes, and the ability to solve problems. Further she cited that correlations between health, vigor, and physical abilities support the belief that physical training has beneficial effects on school competency.

She qualified her views by noting that children with movement deficiences can achieve high academic standing. She agreed with Cratty that there is no direct correlation between movement difficulties and learning difficulties. Further she noted that research has shown that it is the observation of movement rather than movement itself that is crucial for the development of perceptual abilities.

Frostig concluded: "These considerations do not contradict the importance of movement education. Rather, they indicate the importance of providing experiences and opportunities for observation and perception in addition to teaching movement skills" (Frostig, 1980, p. 113).

Cratty (1972, 1975, 1979) cautiously promoted the use of movement education to benefit academics. He felt that there has been an over statement in the importance of movement to academic competence. Movement education does not remediate all learning problems and correlations between motor abilities and intellectual competencies has been statistically low (Cratty, 1975, p. 4). Rather, Cratty described himself as a conceptual-

motor theorist. He stated: "Movement will enhance intelligence to the extent to which children are asked to use their own intellectual and academic capacities and abilities when engaged in various movement tasks" (Cratty, 1979, p. 41).

Summary

From the literature it seems clear that some forms of motor competency do effect academic achievement, namely perceptual-motor, coordination, and balance. Further, it is fairly consistent that organized physical instruction is beneficial to elementary school children and that the earlier this instruction is begun the greater the gains. What is not as clear is exactly what should be instructed.

Programs that focus on only one element, such as strict visual-perceptual training or the Delacato emphasis on creeping (19#4) appear to have more critics than the more generalized movement programs. The reason for this can be surmised. It has not been clearly established that movement in and of itself effects the central nervous system, therefore it is even more shakey to prescribe one specific movement to remediate cognitive difficulties. If creeping is not the perfect remedy for a child's reading problems then a half hour of creeping a day is not only a waste of time, it is also extremely tedious and a turn-off. The researcher has seen groups of thirty children grimly creeping on a linoleum floor for 25 minutes a day. A generalized movement program could incorporate creeping within a context of numerous motor skills as well as academic and social skills. The chance of benefit with such a program would be much greater.

Implications

Implications for further testing point in the direction of clearer definitions. Different forms of movement education need to be assessed for their potential results. In addition, this area seems rich for a qualitative investigation of how children and teachers feel about school and themselves with a movement education program in effect.

The implications for school curriculums is very clear. Movement education can have enormous benefits for academic achievement. It is a valuable tool. As with any tool, it needs to be handled conscientiously and with care. A slap-dash physical education program of jogging and sit-ups will probably do little except perhaps release some pent-up energy. A single minded program that focuses on one movement skill has a low statistical chance of achieving much benefit. These programs are somewhat like throwing a hammer at a nail. On the other hand, a hammer held correctly and swung with grace can hit the nail on the head. A movement curriculum planned with knowledge and understanding can greatly advance the academic, emotional, and social well-being of children. We need to respect physical education for its potential. We need movement programs that fully utilize childrens' intellectual abilities while still providing physical release and exercise. There are such programs available. It would be money well spent.

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